

**MILWAUKEE
PROTECTIVE
COVERS-P.E.I.**



**Design
Handbook**

Thermic-Welded[®] Covers



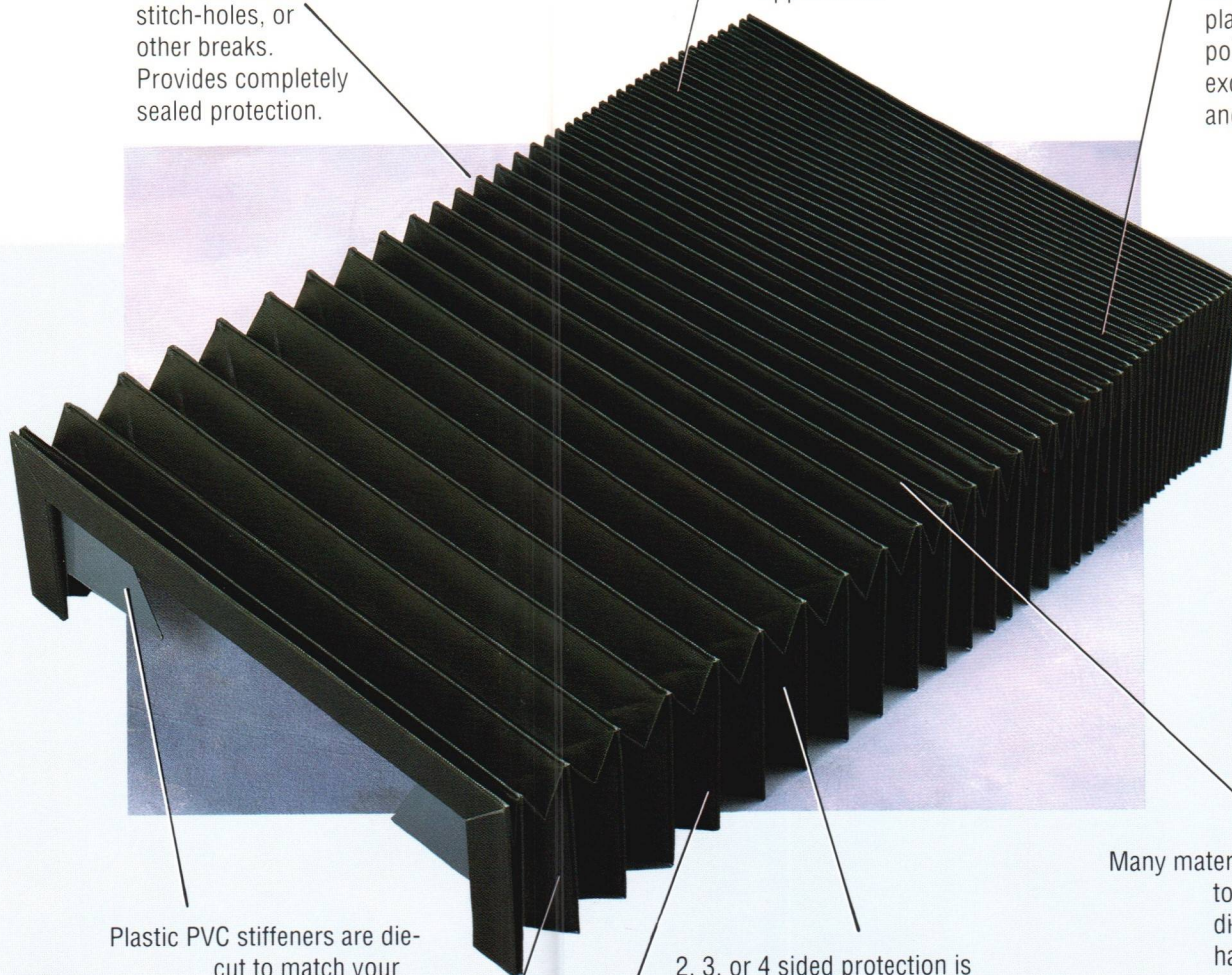
**MILWAUKEE
PROTECTIVE
COVERS-P.E.I.**

ULTRA-HIGH QUALITY PROTECTION FOR YOUR PRODUCT

Cover material is one piece with no seams, stitch-holes, or other breaks. Provides completely sealed protection.

Folds are formed using our patented Thermic Welding[®] process creating a long-lasting, high quality appearance.

Armor-Plates[®] are available to carry heavy chip loads and protect against hot materials. Stainless steel plates are mirror polished, making an excellent looking and durable cover.



Plastic PVC stiffeners are die-cut to match your specifications. Stiffeners support the cover over long travel lengths and in wall or ceiling mounted positions.

Metal end plates are permanently joined to the cover and made to your specifications.

Unlimited open lengths are possible with closed dimensions as tight as 1/40th of open length.

2, 3, or 4 sided protection is available.

Many materials are available to resist chemicals, dirt, heat, and other hazards.

THE COMPETITION

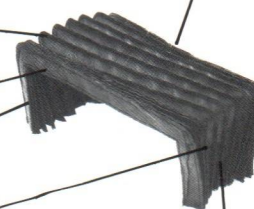
Plain stitching creates many holes, allowing dirt, water and other hazards to reach your product.

Woven threads break down under chemicals or oils.

End plates must be added by customer.

Sides of cover collapse when stretched.

Method of construction restricts open and closed lengths.

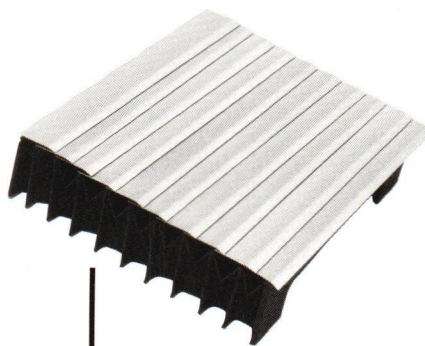


Edges unravel and wear over time.



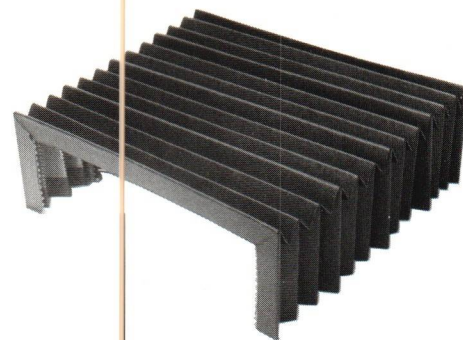
THERMIC-WELDED® COVERS

Thermic-Welded® covers are the most common choice of protection. The ultra-high quality bellows protect, add value, and enhance products and machines. Available in a wide variety of materials and custom shapes. See pages 4-6.



THERMIC-WELDED® COVERS WITH ARMOR-PLATES®

Armor-Plates® carry heavy chip loads and prevent hot materials from damaging the cover. Stainless steel Armor-Plates® can be supplied with any Thermic-Welded® cover. Available in many materials and shapes. See pages 4-6.



GLUED BELLOWS

Traditional style glued bellows are used when plain fabrics or paper covers are needed. Custom shapes are available. Please contact our engineering department for information.



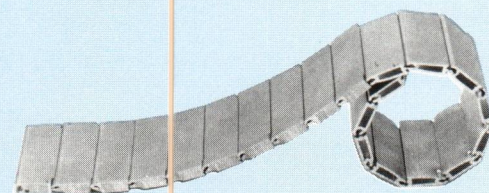
ROLL-UP COVERS

An excellent choice when the cover's storage space is limited. Available in a wide variety of sizes, materials, and mounting methods. See page 7.



ROUND BELLOWS

Heat shrunk or sewn round bellows are used to protect screws or other shafts. Available with or without a velcro seam in many standard sizes. See pages 8-9.



FLEXIBLE ALUMINUM COVERS

The manual style aluminum cover gives easy and inexpensive protection. The motorized system is high quality protection for automatic machines. See page 10.

Thermic-Welded® Covers



ULTRA-HIGH QUALITY PROTECTION

Thermic-Welded® bellow covers give ultra-high quality protection to your product or machine. Our patented manufacturing process makes durable covers with no stitch holes, seams, or breaks. The covers are uniform, consistent, and look good — even for long travel lengths. Standard metal end-plates make installation and service easy. When your protective covers look good, your product or machine looks great!

Please supply the cross-sectional dimensions of your product or machine when ordering.

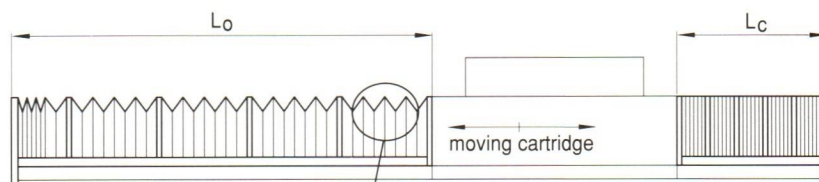


FIG. 4-2

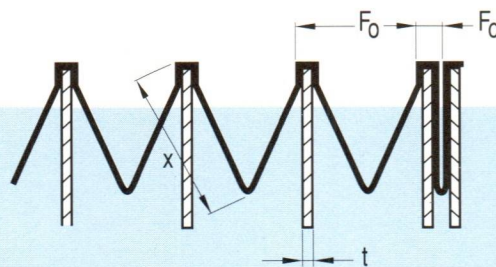


FIG. 4-3

WITH ARMOR-PLATES®

Fixed style for horizontal applications - prevents lifting of protect plates



Flexible style for verticle applications where compactness is needed

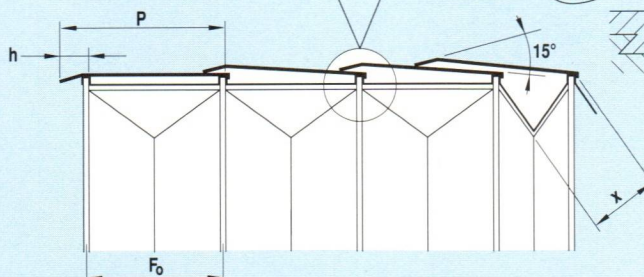
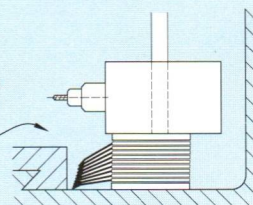


FIG. 4-4

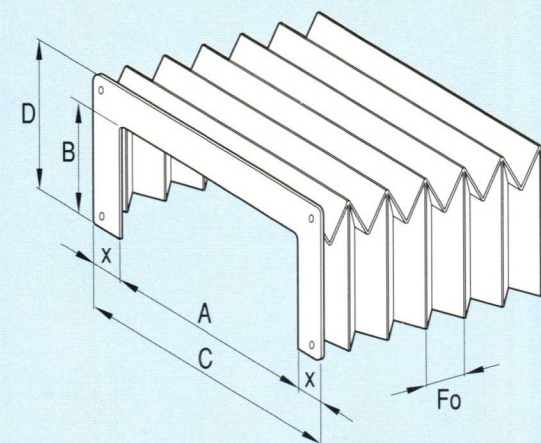


FIG. 4-1

Sizing Calculations

L _o	Cover Open Length	*
L _c	Min. possible closed length of cover	$L_c = N \times F_c$
T	Travel Length	$(T = L_o - L_c) *$
A	Inside Width	*
B	Inside Height	*
C	Outside Width	$C = A + 2X$
D	Outside Height	$D = B + X$
F _o	Fold Open Length	$F_o = 2X - K$
N	Number of Folds	$N = L_o / F_o$
P	Length of Armor-Plate®	$P = 2X + H$

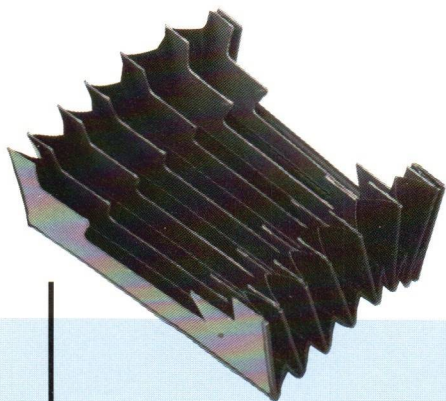
* Customer specified dimensions

Design Data

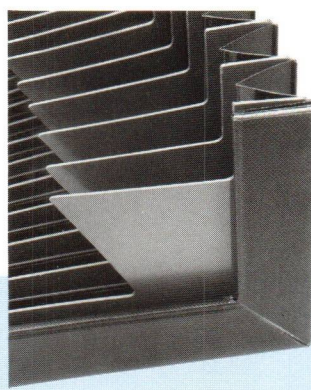
			inches	mm
X	Fold Height	suggested min.	0.80	20
		standard	1.25	32
		suggested max.	1.80	45
K	Constant rule of thumb to prevent overstretching folds	standard covers	0.30	8
		covers with Armor-Plates®	0.60	15
		w/ thin stiffener	0.12	3
F _c	Fold Closed Length	w/ standard stiffener	0.16	4
		w/ heavy duty stiffener	0.20	5
		thin	0.02	0.5
t	Thickness of PVC Stiffener	standard	0.04	1
		heavy duty	0.06	1.5
H	Armor-Plate® overhang		0.16	4

**ULTRA-HIGH QUALITY PROTECTION
FOR YOUR PRODUCT**

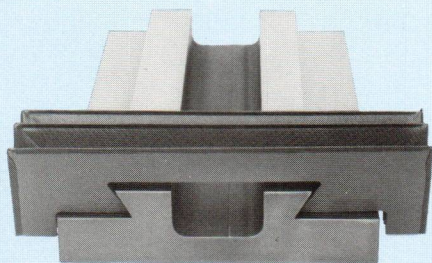
PRODUCT FEATURES



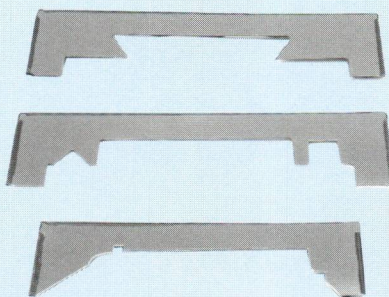
Each fold is welded using our patented Thermic Welding® system. PVC stiffeners are integrally welded at every fold.



Metal end plates are standard in Thermic-Welded® covers, eliminating the extra time, trouble, and expense of fabricating your own flanges. Drilled or tapped holes can be added according to your specifications. A wide variety of materials and thicknesses are available.



PVC inserts are die cut to your exact specifications. Please supply profile dimensions of your product or machine when ordering.



Custom-cut PVC inserts maintain the shape of the cover over long open lengths. They form around your product, allowing wall-mounted or ceiling-mounted covers without wire, guide rods, or other outside supports needed.

Thermic-Welded® Covers



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ULTRA-HIGH QUALITY PROTECTION

Shown here are examples of the many sizes, shapes, and styles available. We customize to your specifications. Please supply dimensions of your machine or product when ordering.

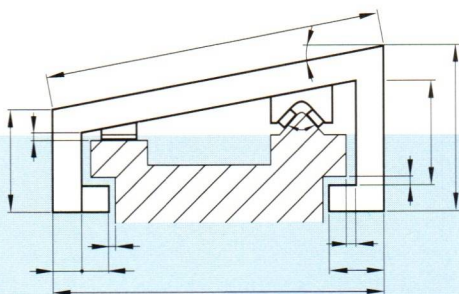


FIG. 6-2

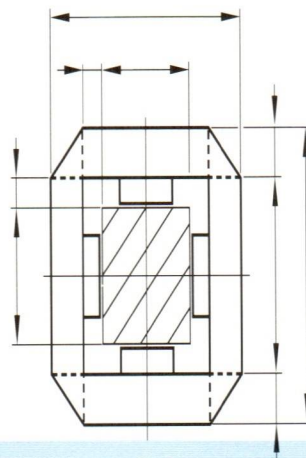


FIG. 6-1

Multiple-sided protection is available.

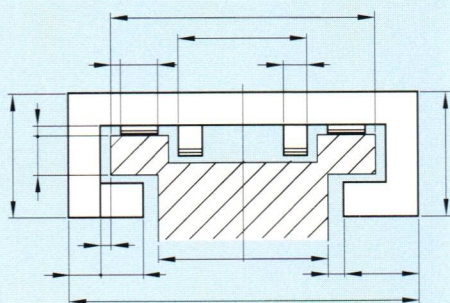


FIG. 6-4

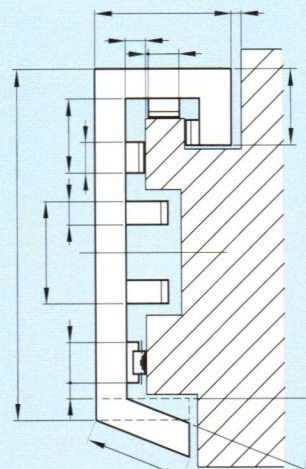


FIG. 6-3

"Wall-Mount"

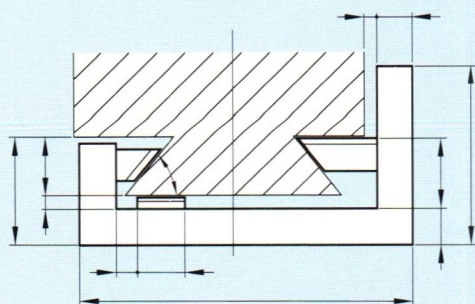


FIG. 6-5

Inverted "Ceiling-Mount"

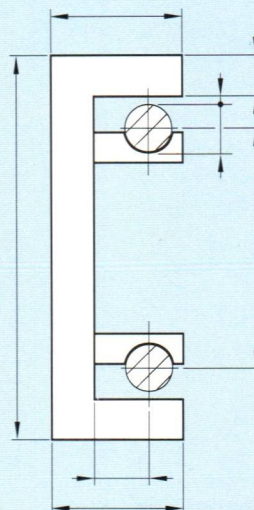
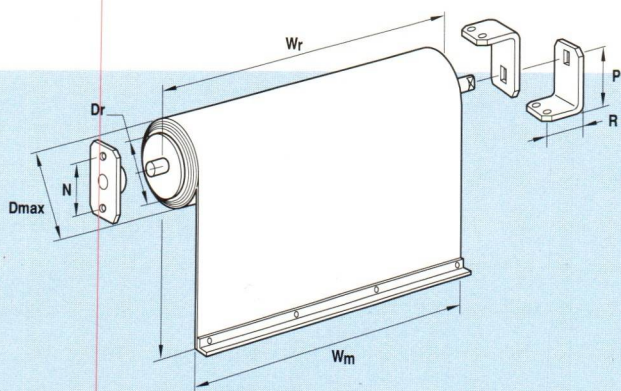
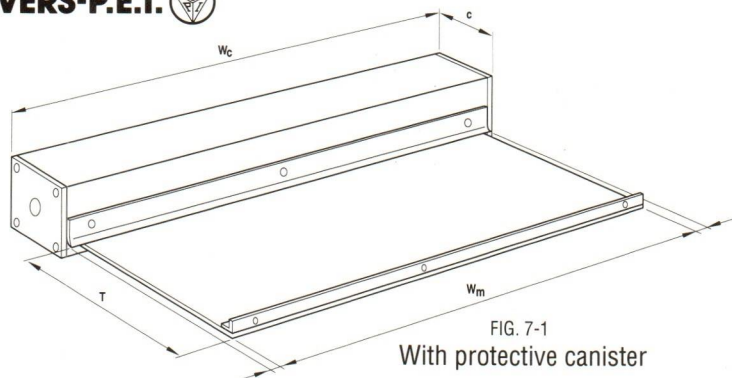


FIG. 6-6

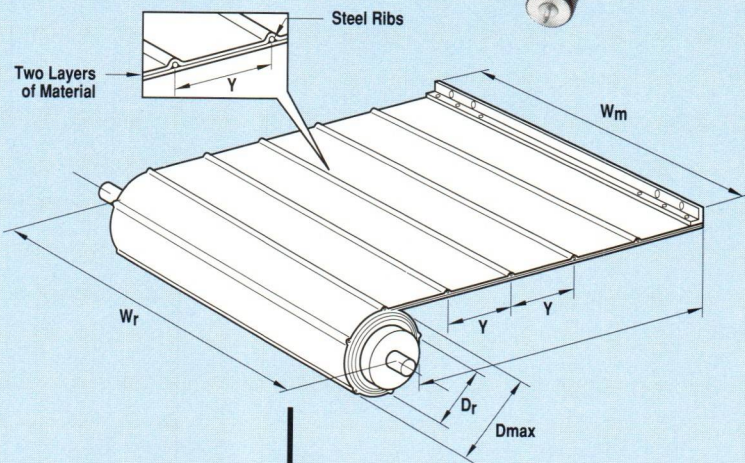
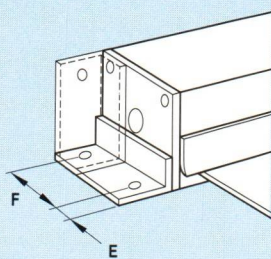
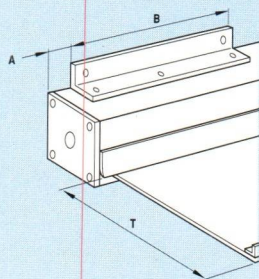
"Wall-Mount"

Roll-Up Covers

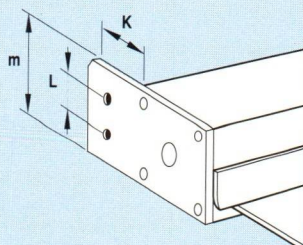
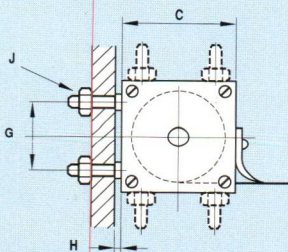
Roll-up covers are a good alternative to the bellow style covers when space is limited and the complete seal of a bellows cover is not needed. Roll-up covers are available in many different materials and can be highly resistant to heat, chemicals, oils, and dirt. They are quickly assembled and can be mounted in many different ways. Contact our engineering department for assistance.



Wide Variety of Mounting Styles



Also available in a ribbed-style for heavy duty applications, (with or without protective canister).



Wr	width of roller
Wm	width of material
Wc	width of protective canisters
C	canister size
Dr	diameter of roller
D max	maximum diameter of roll
T	travel length

Round Bellows

Round bellows offer compact protection for precision ball screws, ball splines, lead screws, or cylinder rods. These versatile covers are available in a wide variety of materials and styles. Fully sealed heat-formed bellows are especially popular for liquid- and dust-tight applications. A velcro seam can be supplied to make installation and service easy. No set-up charges or minimum order quantities are needed. We have many standard sizes available.

Materials

PVC-coated cotton fabric
PVC-coated nylon
Neoprene- and Hypalon-coated nylon
Silicone-coated fiberglass
Latex rubber
Other materials available



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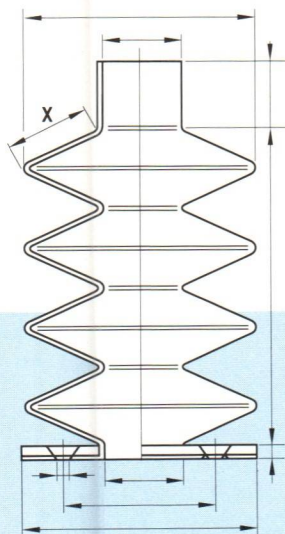


FIG. 8-1

HEAT-FORMED SEAMLESS

Liquid-tight Applications
Dust-tight Applications
High Strength
Heat Resistant
Stiffener Rings Available

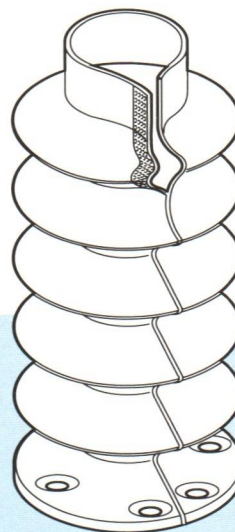


FIG. 8-2

HEAT-FORMED WITH VELCRO SEAM

Fast and Easy Assembly
Fast and Easy Service
High Strength
Heat Resistant
Stiffener Rings Not Available

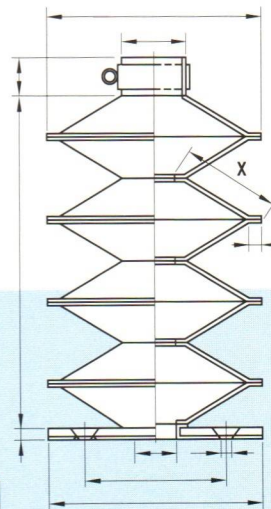


FIG. 8-3

SEWN CONSTRUCTION

Small Compressed Length
High Resistance to Rotation
Stiffener Rings Available

Closed
Length =

inches	mm	inches	mm	inches	mm
$\frac{.10 \text{ open length}}{1.4x}$	$\frac{2.5 \text{ open length}}{1.4x}$	$\frac{.2 \text{ open length}}{1.4x}$	$\frac{5 \text{ open length}}{1.4x}$	$\frac{.06 \text{ open length}}{.05(x-.24)}$	$\frac{1.5 \text{ open length}}{1.2(x-6)}$



Round Bellows Options

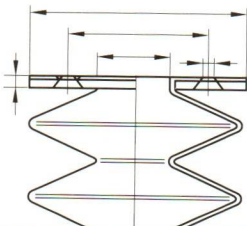


FIG. 9-1

FLANGE STYLE END

Available one or both ends, with or without mounting holes

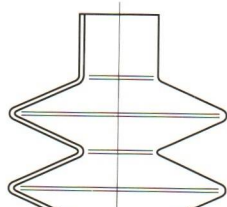


FIG. 9-2

CLAMP STYLE END

Available one or both ends

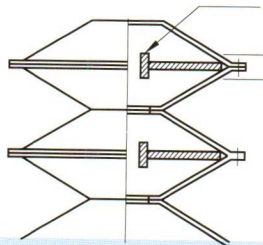


FIG. 9-3

INTERNAL GUIDE RINGS

Variety of materials and sizes

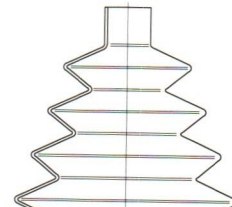


FIG. 9-4

CONICAL BELLWS

Other non-standard shapes available

SAMPLE OF STANDARD SIZES AVAILABLE

This is an abbreviated list of the many standards available. Please inquire if your desired dimensions are not shown.

HEAT-FORMED BELLWS

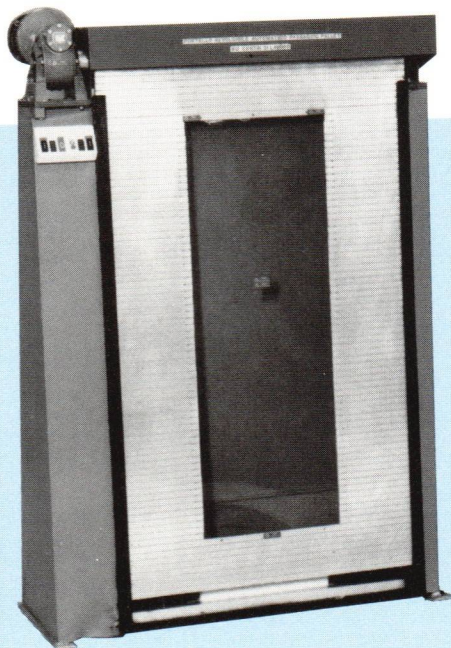
ID		OD		ID		OD		ID		OD	
inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
0.63	16	1.18	30	3.35	85	5.71	145	8.27	210	10.04	255
0.71	18	0.98	25	3.74	95	4.41	112	8.82	224	11.02	280
0.79	20	1.18	30	3.94	100	5.31	135	9.57	243	11.22	285
0.98	25	1.57	40	4.13	105	6.30	160	10.63	270	12.80	325
1.18	30	1.97	50	4.33	110	5.91	150	11.81	300	14.17	360
1.38	35	1.97	50	5.12	130	7.87	200	13.11	333	15.20	386
1.97	50	3.39	86	5.51	140	7.48	190	15.75	400	18.11	460
2.05	52	3.62	92	6.30	160	7.64	194	17.52	445	19.88	505
2.36	60	4.02	102	6.69	170	8.27	210	19.29	490	21.54	547
2.95	75	4.53	115	6.97	177	7.80	198				
3.15	80	4.33	110	7.32	186	9.29	236				

SEWN BELLWS

ID		OD		ID		OD		ID		OD	
inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
0.79	20	1.93	49	2.56	65	4.72	120	4.92	125	6.50	165
0.98	25	2.44	62	2.76	70	3.94	100	5.12	130	6.69	170
1.18	30	2.36	60	2.76	70	5.51	140	5.51	140	11.02	280
1.18	30	3.94	100	2.99	76	4.72	120	5.91	150	8.66	220
1.38	35	2.56	65	3.15	80	4.13	105	6.30	160	8.27	210
1.57	40	3.35	85	3.15	80	7.87	200	6.69	170	8.46	215
1.77	45	2.95	75	3.35	85	4.72	120	7.09	180	9.45	240
1.77	45	7.48	190	3.54	90	5.51	140	7.48	190	8.86	225
1.97	50	3.74	95	3.74	95	5.71	145	7.87	200	11.81	300
2.17	55	3.27	83	3.94	100	5.12	130	8.27	210	10.43	265
2.17	55	4.72	120	4.13	105	6.10	155	9.45	240	13.78	350
2.36	60	3.54	90	4.33	110	5.91	150	11.57	294	14.17	360
2.36	60	5.91	150	4.53	115	7.68	195	11.81	300	14.17	360
2.56	65	3.35	85	4.72	120	7.09	180	13.39	340	16.14	410

Flexible Aluminum Covers

Flexible aluminum covers provide an inexpensive and easy method for covering simple machines. Aluminum covers are available with a winding mechanism, or can hang under their own weight. Please contact our engineering department with your application needs.



Automatic motorized shutters are popular additions to palletized machining centers. These are custom-designed to fit your application. Options such as viewing windows, safety switches, and different motor speeds are available. Please contact our applications engineers to discuss your needs.

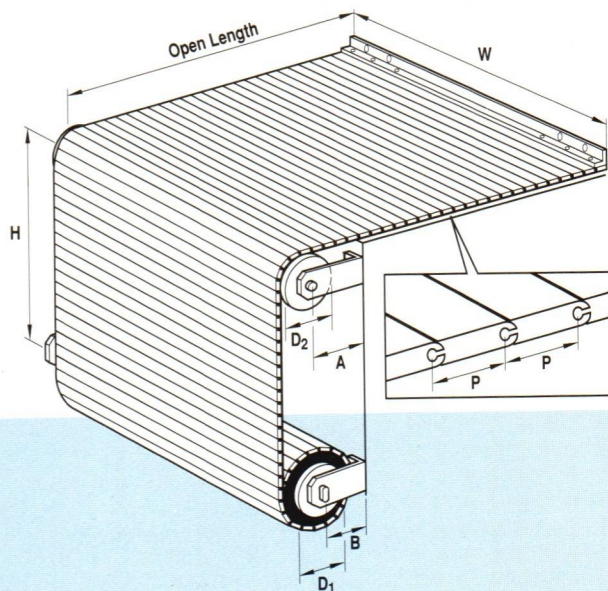


FIG. 10-1

SOLID CONSTRUCTION

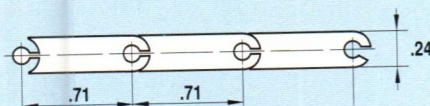


FIG. 10-2

Type A

30 lb/ft² capacity
2.5" minimum wind diameter

HOLLOW CONSTRUCTION

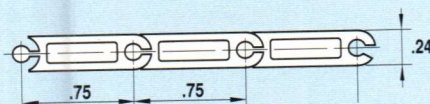
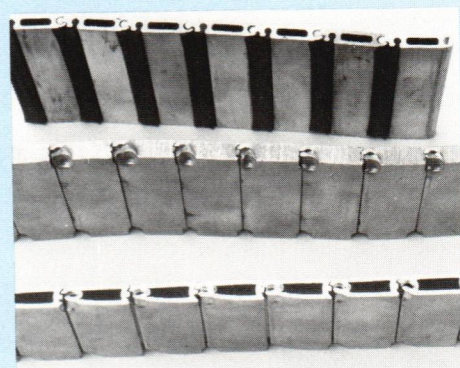


FIG. 10-3

Type B

20 lb/ft² capacity
2.0" minimum wind diameter



HOLLOW CONSTRUCTION WITH SILICONE SEALS

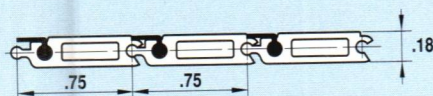


FIG. 10-4

Type 4R

10 lb/ft² capacity
1.6" minimum wind diameter



Applications

ULTRA-HIGH QUALITY COVERS ARE USED IN MANY APPLICATIONS

Industrial Machinery

- Machine Tools
- EDM Equipment
- Grinding Machines
- Bridgeport Machines
- Protection of Die Sets
- Robotics Applications
- Woodworking Equipment
- Electro-Chemical Machines
- Injection Molding Equipment
- Food Processing Equipment
- Conveyor Systems
- Transfer Lines
- Construction Equipment
- Paper Making Machinery
- Paper Converting Equipment

Industrial Products and Components

- Linear Bearings and Linear Guides
- Ball Screws and Ball Splines
- Linear or Rotary Actuators
- Air or Hydraulic Cylinders
- Pick and Place Devices
- Testing and Measuring Equipment
- Automated Handling Equipment
- Safety Guards and Products
- Food Service Equipment
- Scissor Lifts and Jacks
- Welding Products
- Laboratory Devices
- Electrical Cabinets

Consumer Products

- Cameras
- Photographic Equipment
- Workshop Equipment and Machinery
- Automotive Repair Equipment
- Gearshift and Control Sticks
- Dental Chairs
- Hand Tools

Unique Applications

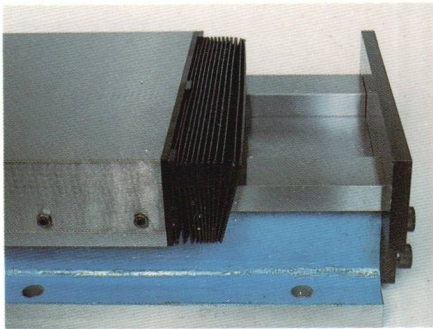
- Connections Between Buildings
- Expansion Joints
- Flexible Covers for Airport Jetways
- Articulated and Flexible Buses
- Air Ducts

STANDARD SIZES AND KITS ARE AVAILABLE

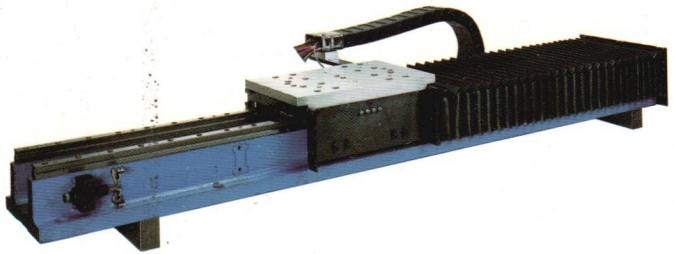
- Bridgeport Mills
- Popular Linear Bearings and Guides
 - Thomson Shafts
 - THK
 - NSK
 - IKO
 - Tsubaki
- Ball Screws and Ball Splines

NEED MORE INFORMATION?

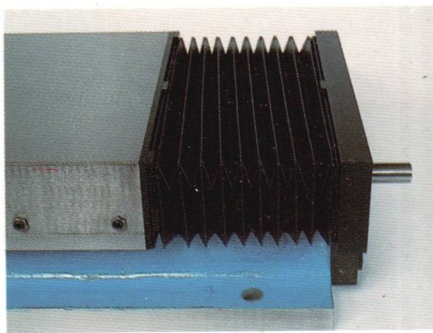
Our engineers are ready to assist you in selecting the best cover for your application. We have detailed technical bulletins and specifications available. Material data sheets and drawings of common applications can be sent by fax to assist you. We look forward to quoting on your protective cover needs. Please call us.



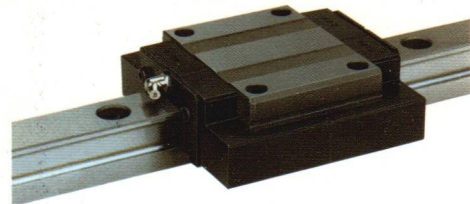
Hardened Way slides are well protected.



Ball Screws and precision guides need ultra-high quality protection.

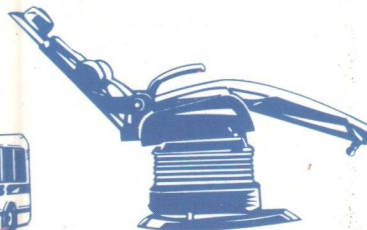
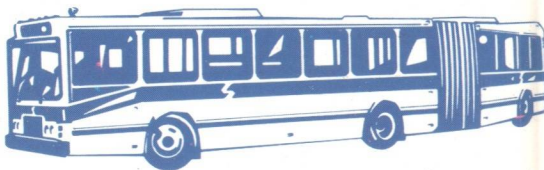


Ultra-high quality covers add value to your product or machine.

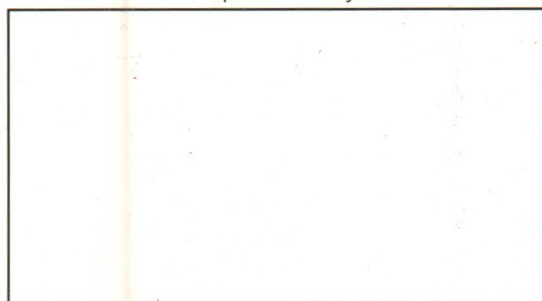


Thermic-Welded® covers are excellent for covering linear guides. Many standards are in stock.

Milwaukee Protective Covers have uses in many different products.



Represented by:



Milwaukee Protective Covers – P.E.I. reserves the right to change any specifications or information in this manual without notice. Our warranty is for the value of our products only. Milwaukee Protective Covers – P.E.I. cannot be responsible for consequential damages.

